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Dated 29 October 1999

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The Patent Office

24 MAY 1999
Cardiff Road
Newport
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1. Your reference J41633GB

2. Patent application number
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9912046.1

3. Full name, address and postcode of the or of each applicant (underline all surnames)

BRITISH AIRWAYS PLC
Waterside (HB A3)
PO Box 365
Harmondsworth
West Drayton UB7 0GB

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

4089655002

4. Title of the invention A SEATING UNIT

5. Name of your agent (if you have one)

R.G.C. JENKINS & CO.

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

26 Caxton Street
London SW1H 0RJ

Patents ADP number (if you know it)

950001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country	Priority application number (if you know it)	Date of filing (day / month / year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

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Continuation sheets of this form

Description 10

Claim(s) 4

Abstract

Drawing(s) 9

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

6 sheets of notes

11.

I/We request the grant of a patent on the basis of this application.

Signature

R.G.C. Jenkins

Date

R.G.C. JENKINS & CO.

24 May 1999

12. Name and daytime telephone number of person to contact in the United Kingdom

GEORGE A. WHITTEN

Tel: 0171 - 931 7141

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A SEATING UNIT

This invention relates to a seating unit of the kind disclosed in our co-
pending application No. 9822545.1, filed 15 October 1998. In the following
5 there will be described further advantages, features and embodiments of the
invention.

According to one aspect of the invention there is provided a pair of
seats, one for facing forward and the other for facing aft when fitted in an
aircraft, each seat defining a major occupancy area and a minor occupancy
10 area extending away from the major occupancy area along a seat axis and
comprising a wall to one side of the major occupancy area, the seats being
positioned adjacent to each other such that the walls of the seats share a
common axis offset with respect to the seat axes to define a major occupancy
area in one of the seats which is larger than the minor occupancy area in the
15 other of the seats.

According to another aspect of the invention there is provided a
seating unit for an aircraft, the seating unit comprising a pair of
complementary seats facing in opposite directions with each seat comprising a
seating portion for receiving the seated body of an occupant and an extension
20 portion in which the legs of an occupant may be placed, the seats being
positioned each side of a notional dividing line with the seating portion of one
extending over the line at the extension portion of the other.

According to a further aspect of the invention there is provided a pair of aircraft seats arranged in a Yin-Yang configuration in which space for a first portion of one seat is increased at the expense of space for a second portion of the other seat, the configuration being such that in use one seat of the pair will face to the fore of an aircraft and the other will face to the rear.

According to a further aspect of the invention there is provided a pair of seating units for an aircraft cabin, the seating units arranged to be adjacent and face in substantially opposite directions in the cabin and wherein, the space made available for an occupant in one seat overlaps the space made available for an occupant of the other seat.

According to a further aspect of the invention there is provided a secondary unit for an aircraft seat the unit comprising a pad mounted to a support of variable height and being pivotable between a latched position and a deployed position.

The above and further features of the invention are set forth with particularity in the appended claims and together with advantages thereof will

become clearer from consideration of the following detailed description of an exemplary embodiment of the invention given with reference to the accompanying drawings.

In the drawings:

Figure 1 shows a side view of a pair of seats;

Figure 2 shows a plan view of a pair of seats;

Figure 3 shows a plan view of plural seats;

Figure 4 shows an accommodation unit;

Figures 5 to 7 show a side view of a pair of seats; and

Figure 8 shows a plan view of plural seats.

5 Turning now to Figure 1 of the drawings there is shown a pair of
seating units (1) and (2). Each pair of seats is mounted on a pallet (not
shown) which in turn is mounted on the aircraft cabin floor. However, each
seat is in itself a separate structure from the other seat. Each seating unit
comprises a primary seat (3) within a housing (4) which houses a back portion
10 (5) and a seating portion or pan (6). Facing each primary seat is a secondary
unit (7). Figure 1 shows each seat in a retracted position in which the back is
substantially upright. Each seat may also be configured in an extended
position, in which the back portion (5), the seat portion (6) and the secondary
unit co-operate (7) to form a substantially flat surface.

15 The seat includes a reclining mechanism (not shown) to allow the back
portion to recline as the seating portion is moved forward. The seating
portion is supported on a trolley member (8) which is driven forward along
the cabin floor to move the seat into the extended position. The seat is driven
by electric motors by way of a control panel. Suitable reclining mechanisms,
20 a trolley and electric motors are all described in our co-pending application
No. 9525263.1 which describes another seating unit for an aircraft.

It is intended that the seats described in Figure 1 will be used in the business class cabins of aircraft. Efficient use of space is at a premium in such cabins and the seats have been designed with this in mind. It can be seen in Figure 1 that storage space for a passenger of one seat is provided in the side of and underneath the adjacent seat. This optimises the use of space.

Figures 2a and 2b show two pairs (9, 10) of seating units arranged in an aircraft cabin. In Figure 2 the seats are shown in various configurations or modes including a seating mode, a reclining mode and a bed mode. The two seats in a pair are arranged side by side, with one seat of the pair facing forwards towards the front of the cabin and the other seat of the pair facing backwards towards the rear of the cabin. To maximise the efficient use of space, each seat has been designed so that the space (11) available for the upper part one occupant overlaps the space that would otherwise be made available for the lower part of an adjacent occupant. Furthermore, each seat in a pair has an arm rest (12) which lies along a common axis with a similar arm rest (12) on the other seat of the pair. This allows for more elbow space on the shared side of adjacent seats. This arrangement makes for efficient use of space when arranging the seats in an aircraft cabin. Furthermore, the width of each seat tapers in the direction going from the back of the housing (13) towards the secondary unit (7). This takes advantage of the fact that a human occupant is broader across the shoulders than across the bottom of the legs.

Thus, extra space is provided where it is needed for the body of a passenger and less where it is not needed for the legs.

One possible arrangement of the seats in a cabin is shown in Figure 3. In this arrangement eight seats are provided across in the cabin. Previously
5 with seats of a similar size to those described herein, because of minimum aisle width and seat cushion width requirements, it has only been possible to arrange seven abreast in such a cabin. In the arrangement shown in Figure 3 all aisle seats face forwards, and all window seats or centre seats face rearward. An access space labelled X, enables passengers to enter a seat with
10 a minimum of disturbance to other passengers.

The seating portions and the back portions of the seating units described herein may be orientated in a number of pre-set orientations between an upright orientation, wherein an occupant can comfortably eat or work and the bed orientation wherein an occupant can sleep. At take-off and
15 landing the axis of the aircraft is inclined at an angle to the horizontal. A typical angle may be, say, 15° to the horizontal. One of the pre-set orientations is designed for take-off and landing. In this position the back rest of the seats is inclined and fixed at an angle intermediate the angle used for working/eating and the angle used in the flat bed orientation. Also, in this
20 position, solenoid actuated pins or the like (not shown) are arranged to lock the seat in position, thereby providing the necessary security for the passenger during taxiing, take-off and landing. This may be regarded as the normal

"rest" position for the seat, with the seat moving forward to reclined or sleep positions and backward to work and dine positions.

In this intermediate orientation or rest position the angle of the seat is set to a predetermined angle. This intermediate orientation helps cater for and makes occupants feel more comfortable with the take-off/landing angle of the aircraft. Preferred seat and back rest angles for the intermediate take-off/landing orientation are given in the attached list. The list also includes preferred angles for other pre-set orientations.

Description	Seat Angle (to horizontal)	Backrest Angle (to vertical)	Notes
Upright working and eating orientation	4°	13°	
Partially upright	10°	20°	This will function as a slightly more reclined working and eating posture, for those passengers who consider the 4°/13° setting too upright.
Half reclined	12.5°	25°	We expect this position to function as a semi-reclined position for IFE watching and reading.
Taxi, take-off and landing (TTOL)	15°	30°	TTOL for both forward- and rearward-facing seats.
Reclined	15°	38°	Final reclined posture, prior to articulation into bed mode.

Figures 1 and 2 also show the secondary unit or foot stool which faces each primary seat. The unit comprises a support portion (15) for supporting a pad (16) on which an occupant can rest his feet. The support portion (15) is lever-operated to raise and lower the pad (16) between a maximum upright position whereat the stool can co-operate with the primary seat (3) to form a bed and a lower position. The pad is rotatable about the support portion and may be flipped up vertically and latched for take-off and landing as shown with respect to pads (16a) in Figure 3. the pad is angular in shape, so that when latched maximum egress space is provided for passengers into and out of the seat. The pad is rotatable substantially in the plane of the cabin floor about a swivel point which is not coincident with the centre of the pad, and may be rotated by 90° in that plane as shown in Figure 2. Even when rotated in the plane of the aircraft, the pad can still be pivoted vertically to allow for passenger egress. The secondary unit is configured so that a force of 300lb exerted therein automatically causes the unit to lower. this is necessary because otherwise under the Civil Aviation Authority rules the unit would be classed as a seat and would therefore require seat-belts.

The rotation of the secondary unit allows the passenger more easily to change position in the seat during a flight. Full support of the passenger's legs will produce even pressure on the legs which in turn will reduce circulation over a period of time. The pivoting allows the passenger to avoid such discomfort and a "dead leg" feeling when getting up out of the seat. The pad

is also dimensioned so that the passenger can place his or her legs on each side of the pad, therefore avoiding the need to tilt the seat into the vertical position when leaving or entering the seat.

Figure 4 shows a self-contained in-flight entertainment unit for use with one of the seating units. In Figure 1 it can be seen that the entertainment unit for one of the seats, is positioned at the body of the adjacent seat, above and between the seat portion and stool of the one seat. The self-contained unit comprises a display monitor (18), headphones point (18a), a PC power point (18b) (not shown in figure 4, but shown in Figure 1), a cocktail table (20), a reading light and take-off/landing seat position indicators. The display monitor (18) is mounted on an arm which is hinged to allow movement in a vertical plane to allow the display to be deployed and is also hinged to allow movement in a horizontal plane so as to set a suitable viewing angle depending on whether the occupant is sitting up or lying down. A latch is provided to lock the unit in position for take-off and landing. The unit is compact and self-contained which facilitates maintenance. Maintenance is further facilitated by the design of the rear shell of the housing. The rear shell of the housing on which the entertainment unit is provided pivots into the above-mentioned pallet and is clipped onto the seating unit. The seating unit is moved manually to the bed position to provide access to the clips. The shell may be unclipped to provide easy access for maintenance of the entertainment unit, including removal and replacement thereof.

The positioning of the entertainment unit allows the co-axial arms of adjacent seats to be narrower than would be possible if any of the features included in the unit were, as has until now been the case, stored in the arms of the seat.

5 Each seat is also provided with a one-piece table (25) which may be stoned in a storage area in an arm of the seat. The table is shown in Figures 2 and 3. To deploy the table, the table is first rotated in the plane of the arm out of the storage area and then rotated down over the passenger's lap. When deployed the table may be slid perpendicular to the arm, in a fore and aft
10 direction to a position at which the passenger is comfortable. The table may also be pivoted between the positions 25a and 25b shown in Figure 2a. The table is shaped and so dimensioned that when in a deployed position, it undercuts the arm of the adjacent seat and is also rotatable in a plane substantially parallel to the aircraft floor.

15 As shown in Figure 1, each seat is also provided with a privacy screen (19) which comprises a plurality of co-operating petal or blade-like structures (19a, 19b), which may be opened and moved into various positions. The
screen dissects the common axis of the arm rests discussed above. The main
function of each screen is to provided eye-to-eye privacy between adjacent
20 seats in a pair, in all the possible orientations that each seating unit can take. The privacy screen is movable to allow adjacent passengers, should they so wish, to have eye contact. Also, in an emergency each screen is movable to

provide access to oxygen masks. To conform with safety requirements, the screen is arranged so that the occupant may move it even when reclined in the bed orientation.

There are a number of ways of arranging adjacent screens so that they
5 be moved to allow adjacent passengers to converse. One possibility is to arrange the screens so that they may be swung away from each other to create space along the centre line between seats. Another suitable arrangement would be arrange so that each screen swung away in the same direction to create space. A third possibility is that each screen comprises a hinge from
10 which the petal structures may be easily released.

A different type of privacy screen may simply comprise a curtain and rail arrangement.

Further features are shown in accompanying Figures 5 to 8 and are also discussed in the accompanying notes.

15 Having thus described the present invention by reference to preferred embodiments it is to be well understood that the embodiments in question are exemplary only and that modifications and variations such as will occur to those possessed of appropriate knowledge and skills may be made without departure from the scope of the invention as set forth in the appended claims and
20 equivalents thereof.

CLAIMS:

1. A pair of seats, one for facing forward and the other for facing aft when fitted in an aircraft, each seat defining a major occupancy area and a minor occupancy area extending away from the major occupancy area along a seat axis and comprising a wall to one side of the major occupancy area, the seats being positioned adjacent to each other such that the walls of the seats share a common axis offset with respect to the seat axes to define a major occupancy area in one of the seats which is larger than the minor occupancy area in the other of the seats.
2. A seating unit for an aircraft, the seating unit comprising a pair of complementary seats facing in opposite directions with each seat comprising a seating portion for receiving the seated body of an occupant and an extension portion in which the legs of an occupant may be placed, the seats being positioned each side of a notional dividing line with the seating portion of one extending over the line at the extension portion of the other.
3. A pair of aircraft seats arranged in a Yin-Yang configuration in which space for a first portion of one seat is increased at the expense of space for a second portion of the other seat, the configuration being such that in use one seat of the pair will face to the fore of an aircraft and the other will face to the rear.

4. A pair of seating units for an aircraft cabin, the seating units arranged to be adjacent and face in substantially opposite directions in the cabin and wherein, the space made available for an occupant in one seat overlaps the space made available for an occupant of the other seat.

5. A secondary unit for an aircraft seat the unit comprising a pad mounted to a support of variable height and being pivotable between a latched position and a deployed position.

10

6. A secondary unit as claimed in claim 5, wherein the pad is rotatable in a substantially horizontal plane.

7. A secondary unit as claimed in claim 5 or 6, wherein the support is arranged to lower when a load in excess of a predetermined maximum is applied to the unit.

15

8. A privacy screen for an aircraft seat, the screen comprising a plurality of blades movable between a storing configuration and a privacy position in which a screen is formed by the blades.

20

9. A multi-mode aircraft seat drivable between a plurality of different seating modes including a take-off mode in which the seat is partially reclined, and in one direction to a fully reclined mode and in another direction to a fully upright mode.

5

10. An aircraft seat comprising a rotatable seat pan rotatable to a plurality of different positions including a take-off position at which the pan is inclined to the floor of the cabin to compensate for the take-off angle of the aircraft.

10 11. An aircraft seat as claimed in claim 9 or 10, comprising latching means for latching the seat in position during take-off.

12. An in-flight horizontal unit comprising two or more of the following in a self-contained unit which facilitates maintenance of the unit, namely:

- 15 a monitor;
a PC power point;
-
- a cocktail table;
a condition indicator; or
an audio output jack.

20

13. An entertainment unit in combination with a pair of seats as claimed in either of claims 1 or 3, or a seating unit as claimed in claim 2 or a pair of

seating units as claimed in claim 4, wherein the unit for one seat is mounted in a housing associated with the other seat.

14. Any novel and inventive feature disclosed herein either alone or in
5 combination with any other feature disclosed herein.

15. A seating unit substantially as described herein.

Notes

inventors at large
Martin J. J. J. J.
Matti R. R.

(1)

1. Yui/Yang overlap

- based around 8 abreast*

- each pair is either L/R or R/L on a pallet

- ~~at~~ effective pitch is 73"

- aisle seat forward

- window seat / centre seat, rearward

but are separate
assemblies - each seat
a separate structure

* has to be this many to be viable

constrained by minimum aisle width

passenger space width (business class = 20")

- buys more elbow space on one side
in the shared side (does not matter on other
side)

- enables an access space to be maintained
not stepping across the body of other
passengers. Each passenger has his own

"bay", which includes the foot-stool, and thus
avoids (minimises) passenger disturbance

- storage for one passenger is provided in side
(underneath) the seat of the other (space
optimization).

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Rear shell (hinging) pivots into pallet and clips into structure within seat (seat can be moved manually to "sleep" position" to provide access to the clips. When shell is removed access is provided easily to the in flight entertainment unit (IFE)

2. Foot stool

- Purely mechanical (not electronic) assembly
- Release lever allows user to change height (mechanism will be similar in ~~function~~ ^{feeling} to an office chair but will be unique in construction).
- At maximum height the stool cooperates with the seat to form a bed.
- 300lb release, so sitting or standing on it will cause stool to lower eg if turbulence is encountered. Otherwise it would have to be a "seat" with seat belts under FAA rules.
- Pad flips up and is latched for take off and landing. Latch not yet designed
- Pad swivels on an off-center swivel point
- angled slightly so that when latched gives max egress space for adjacent passengers
- pivots by 90° in the horizontal plane and when down and pivoted it can be pivoted back up to

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- vertical to allow other passenger egress
- Rotation also allows passenger to change position more easily (full support gives even pressure on legs which reduces circulation making movement difficult - pivoting allows this to be avoided)
 - Pad is dimensioned so that passenger can place legs on each side when leaving seat without having to pivot up the pad.

3 Privacy Petal

... i will be lightweight
 bendy structures with latching

- provide eye-to-eye contact privacy in all modes of the seat across a seat pair (from working and eating (most upright) mode to bed mode).

-
- must (1) be able to move one to provide service to window or centre seat passenger across aisle passenger (2) provide access to O₂ masks - i.e. passenger must be able to push out of the way even when in bed mode. (CAA requirement). (3) be able to move away to allow eye-to-eye contact for passenger

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- conversation - ● by maintaining hinge ● position with quick release blade (4)
- by swinging away from each other to give space along centre line between seats
 - swing both away in the same direction

4. Seat positions

TTOL = Taxi, Take Off Landing

- To cater for angle of incline of plane during TTOL there is an intermediate position between ~~bed and working/erecting~~. • See seat angles note.

TTOL position is where seat will be tested.

Seat is physically latched in this position so that passenger mass is distributed into seat and pallet as the seat "parks" in the TTOL position by way of solenoids controlled electronically

- Gives comfort during take off

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(5)
- bed sits at $1\frac{1}{2}^\circ$ to the floor which means
that fore passenger's head is $1\frac{1}{2}^\circ$ down
aft " " " " " $4\frac{1}{2}^\circ$ up
at cruise because planes cruise at 3°

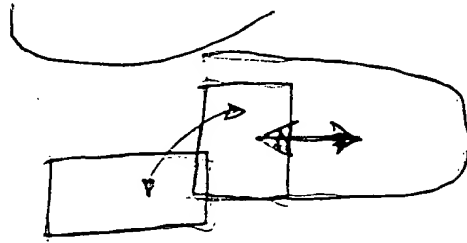
5. In Flight Entertainment

- self contained item holds
headphones out Display
PC power cocktail table
lighting power - reading light and TLOC
position indicator
- seat controls are separate but adjacent and
connected via suitable fails
- Display on arm with hinge in vertical axis
(to enable deployment to rear) and hinge
in horizontal (to get right viewing angle for
passenger height/seat mode) Manual operation
- latches for TLOC with simple latch
- cocktail table shape is defined by arc of
display arm but is positioned above arm
to ~~allow~~ avoid ~~drinks~~ drinks etc. being spilled
- Headphone and PC power leads positioned to
minimise entanglement.

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6. Tray table (i.e. main table)

- has ball hinge in arm.
- one piece table stowed in arm of seat
- rotates in plane of arm out of the stowage area in the arm and then rotates down over passenger's lap
- slides in table allow it to move fore and aft and also rotates like this:



is shaped and dimensioned to undercut arm of other seat when rotated from any position (fore and aft).

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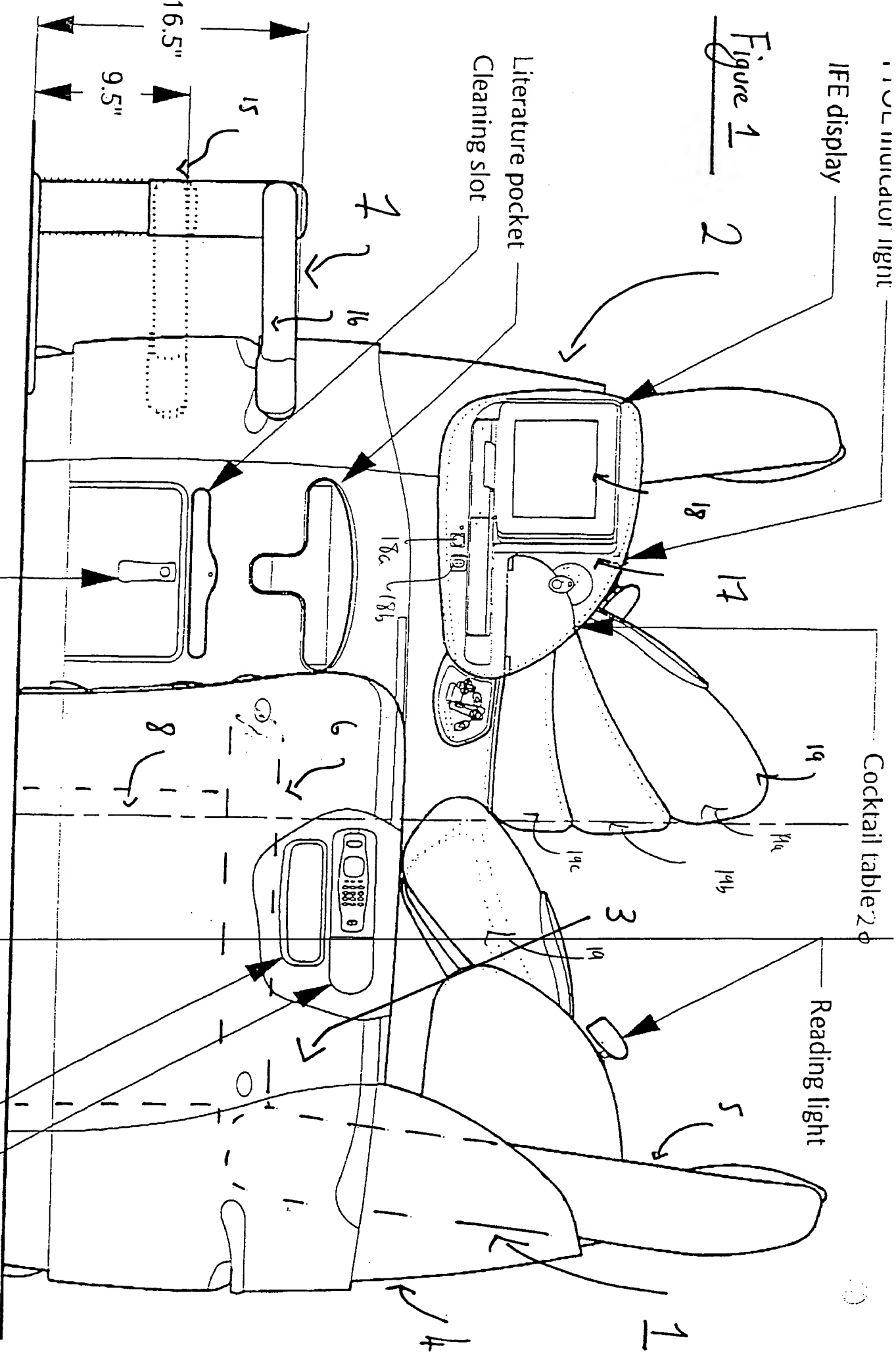
Indicator light

Cocktail table

IFE display

Reading light

Figure 1



IFE handset

Nic-nacs pocket

Life jacket stowage

IFE handset

Nic-nacs pocket

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Top-down view of a vehicle interior showing a seat in bed mode. The diagram includes dimensions: 72 inch bed length, 14.7 inch minimum egress way, and 16 inch seat width. It also shows a tray table, cocktail table, and IFE delayed area. A 13 inch dimension is indicated for the seat base.

er

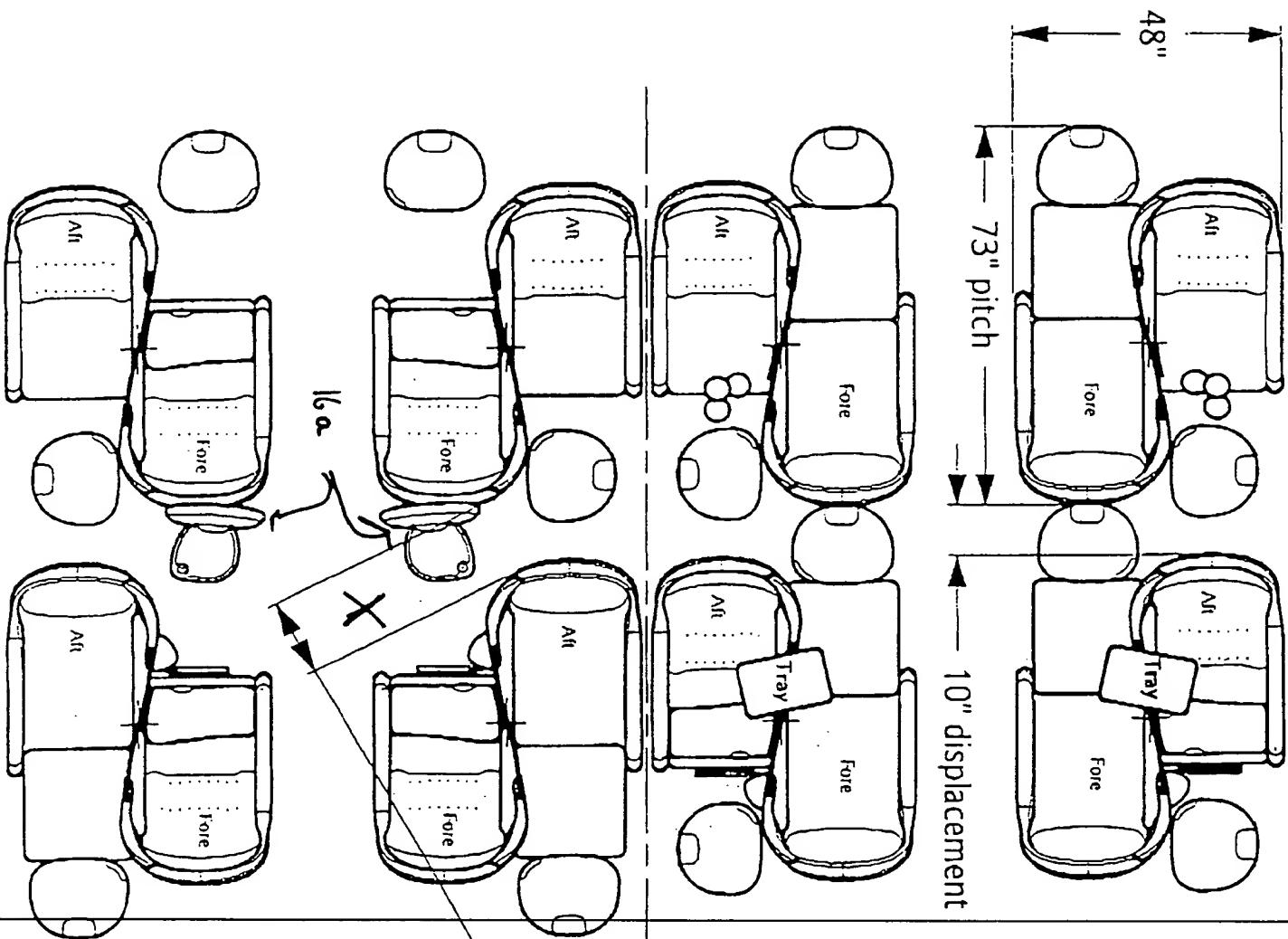
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Figure 3

Towards
Front of
Cabin

Towards back
of Cabin



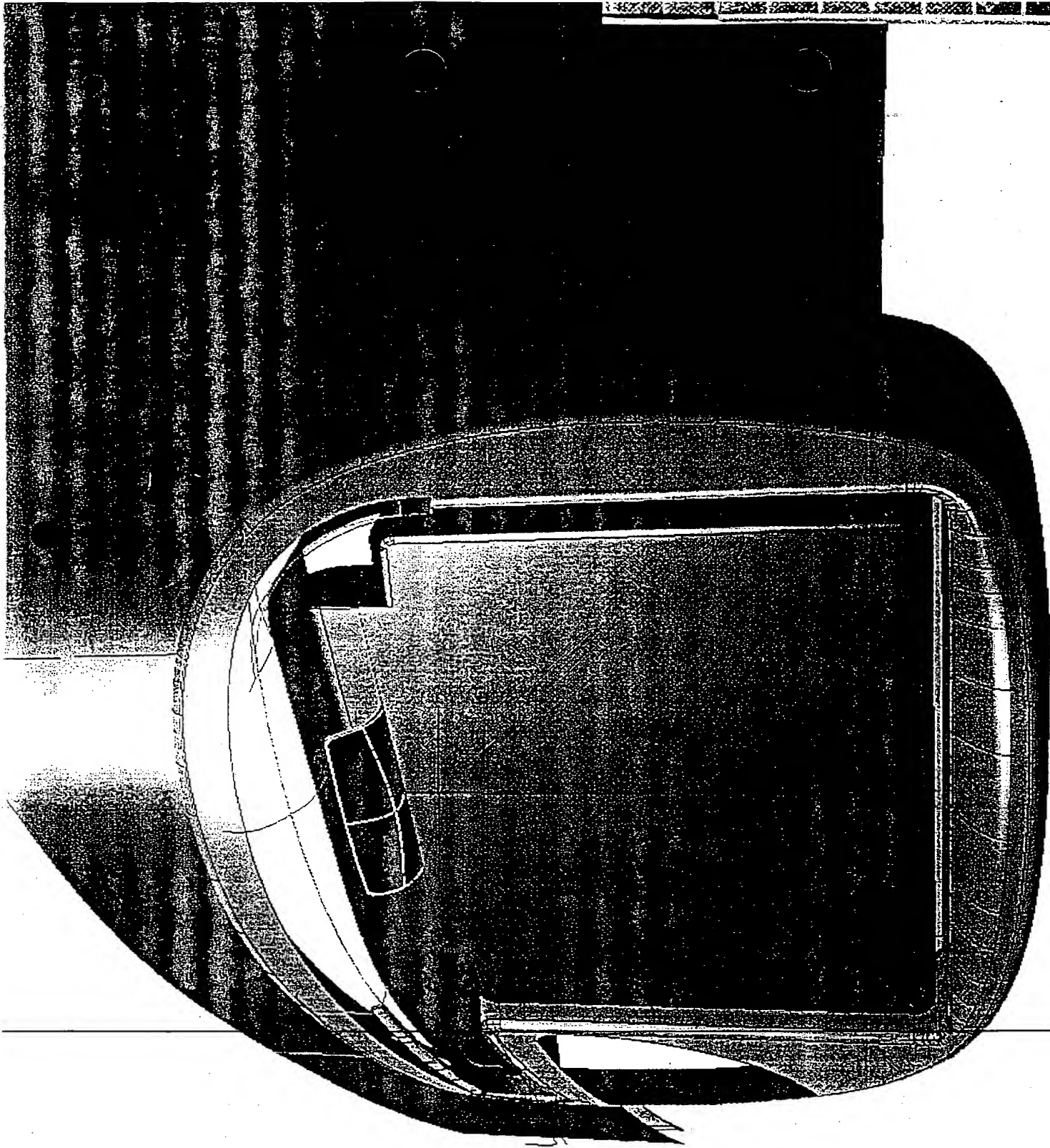
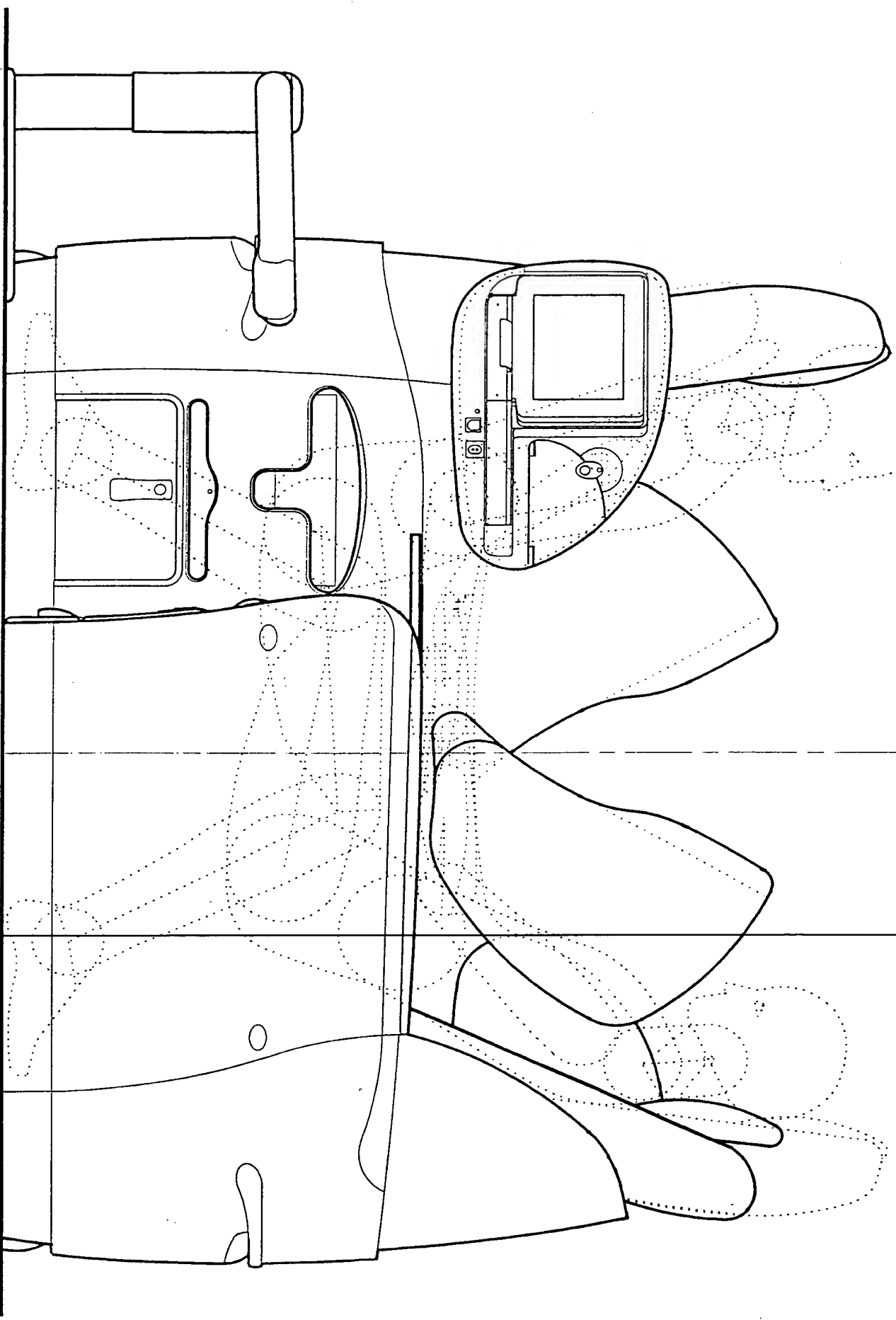


Figure 4--

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Figure 5



W&E - 95%tile manikin

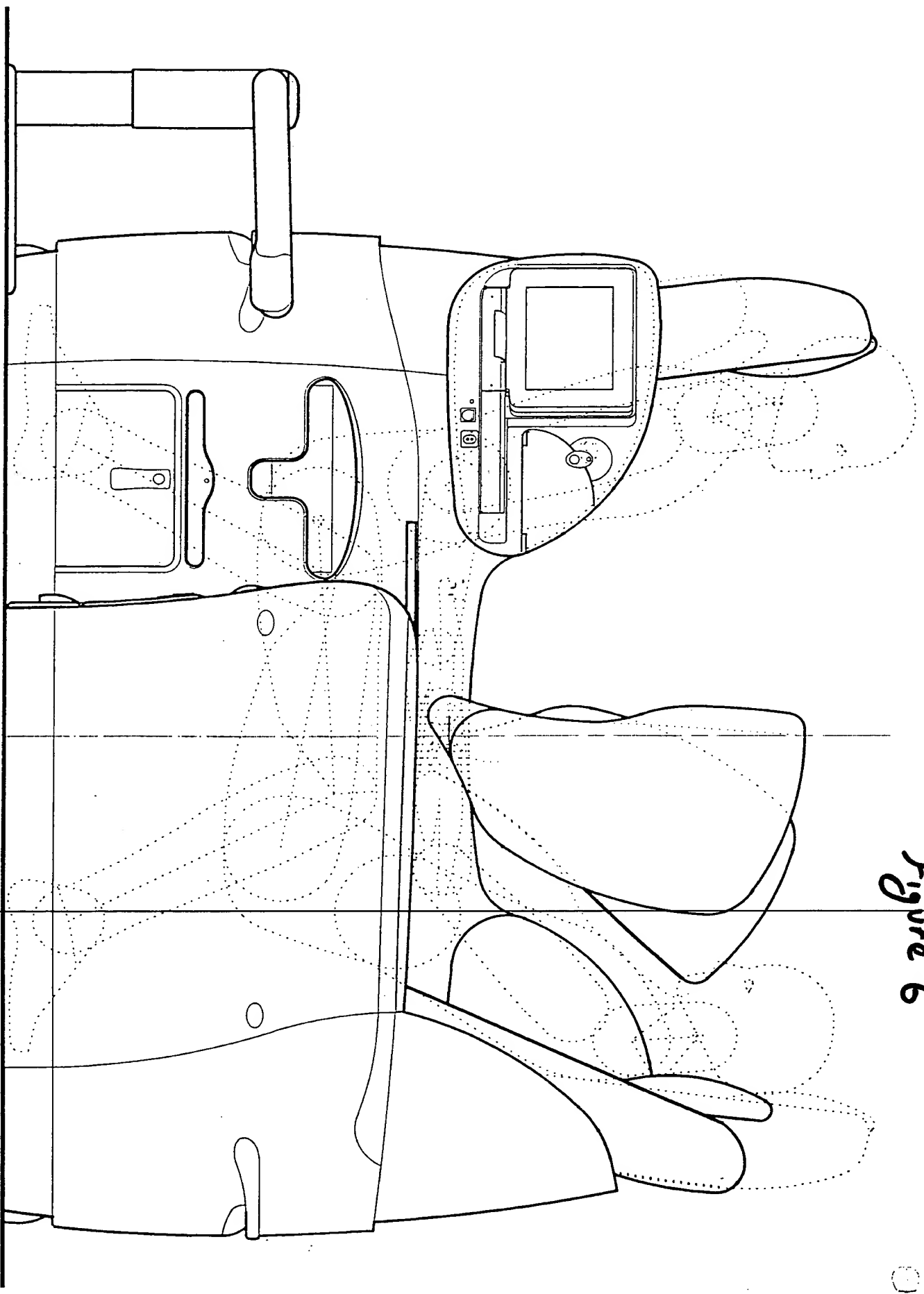
Dusk - Hinging assymetric screen - openness

TTOL- 95%tile manikin

tangerine • 23May 99

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Figure 6



W&E - 95%tile manikin

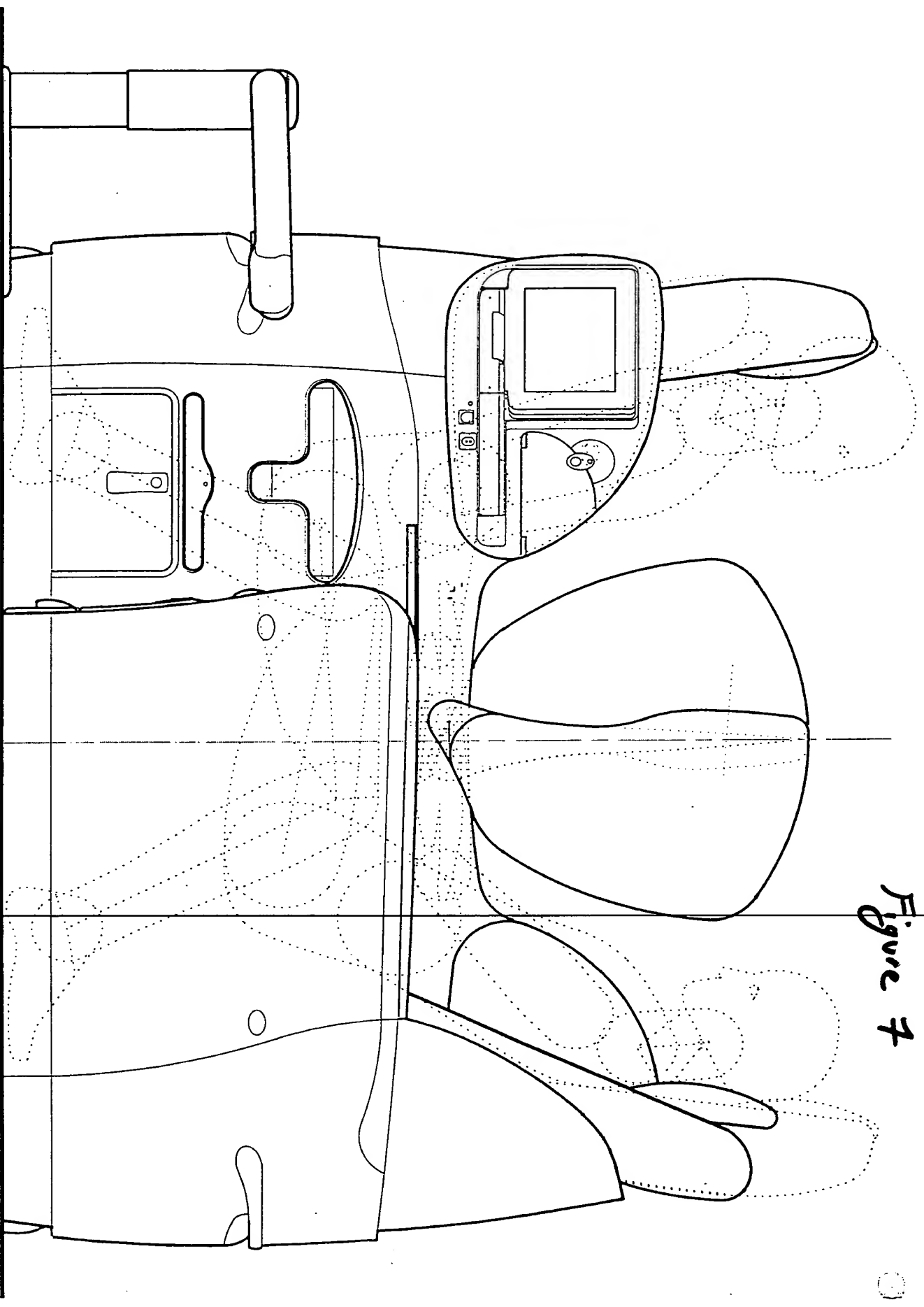
TTOL - 95%tile manikin

Dusk - Hinging assymetoc screen.-service

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Figure 7



W&E - 95%tile manikin

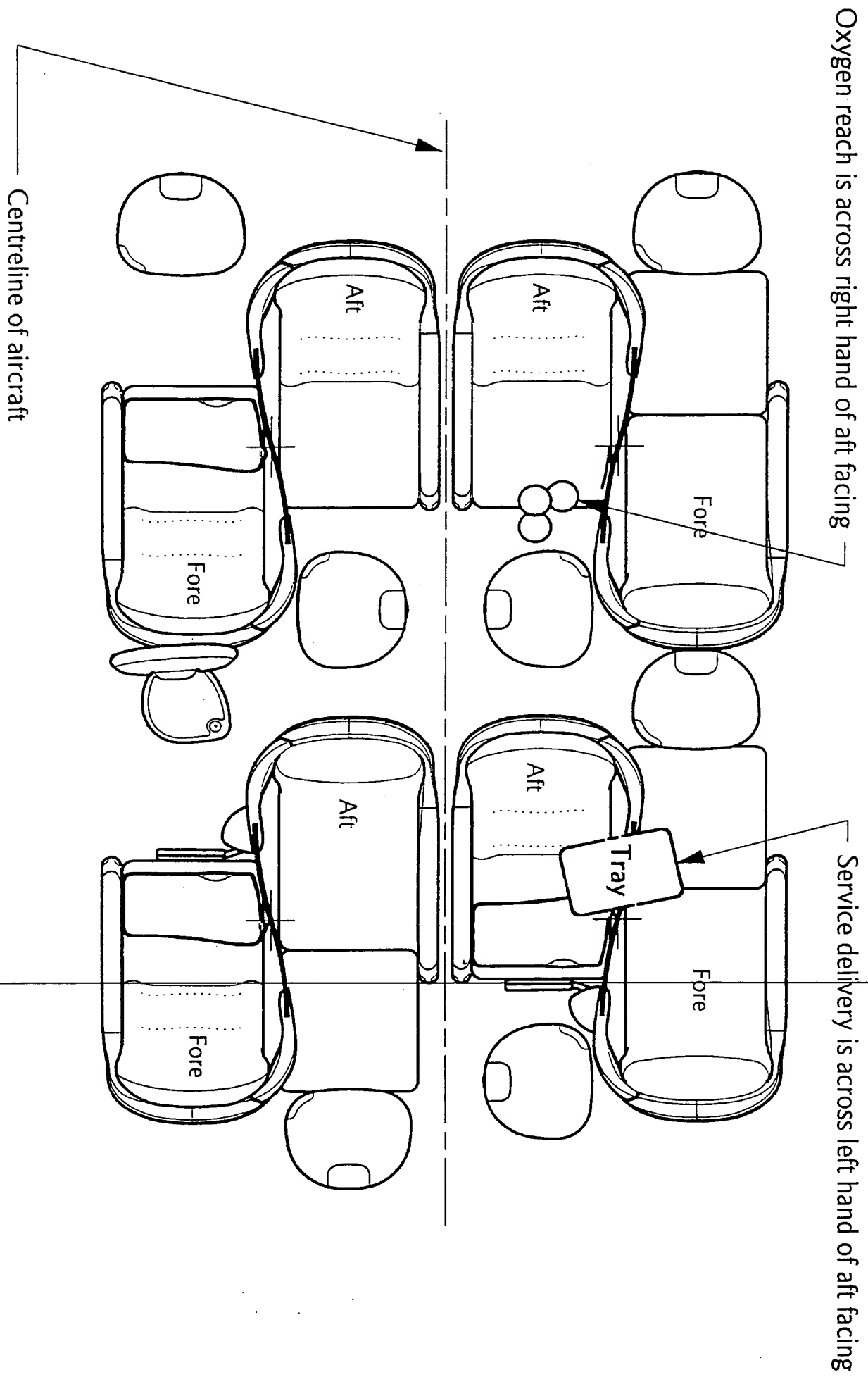
TTOL - 95%tile manikin

Dusk - Hinging assymetric screen - privacy

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Figure 8



DUSK • Service access & oxygen mask drop

PG 684903445

RAC Jenkins & Co

26 10 99

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